



Approval #

990047-U (Replaces 980085-U)

Safety & Buildings Division
201 West Washington Avenue
P.O. Box 2689
Madison, WI 53701-2689

Wisconsin Material Approval

Material

Red Jacket Tank and Line Leak
Detection Systems

Manufacturer

The Marley Pump Company
Red Jacket Electronics
500 East 59th Street
Davenport, IA 52807

SCOPE OF EVALUATION

The RLM 5000, RLM 5001, RLM 9000, ST 1400, ST 1401, ST 1401L, ST 1800, ST 1801, ST 1801L and ProLink systems were evaluated for use as volumetric tank tightness testing methods in accordance with **s. Comm 10.61 (3)** and as automatic tank gauging systems in accordance with **s. Comm 10.61 (4)**.

The PPM 4000, RLM 9000, ST 1401L, ST 1801L, CPT and ProLink systems were evaluated for use in hourly monitoring of rigid piping in accordance with **s. Comm 10.615 (1)**. The PPM 4000, RLM 9000, ST 1401L, ST 1801L, CPT, and ProLink systems were also evaluated for use in hourly monitoring of flexible piping in accordance with **s. Comm 10.615 (1)**.

The PPM 4000, RLM 9000, ST 1401L, ST 1801L, CPT and ProLink were evaluated for use as line tightness testing methods for rigid and flexible piping in accordance with **s. Comm 10.615 (2)**.

The PPM 4000 and RLM 9000 were evaluated for use in continuous monthly monitoring of rigid piping in accordance with **s. Comm 10.615 (3)**.

The ST 1401L, ST 1801L, CPT and ProLink were evaluated for use in continuous monthly monitoring of rigid or flexible piping in accordance with **s. Comm 10.615 (3)**.

The Dispenser Pan Monitor, version RE400-204-5; the Ground Water Monitor, versions RE400-377-5, RE400-378-5 and RE400-381-5 (numbered by length of sensor); the Liquid Refraction Sensor, version RE400-180-5; the Combination High Level/Low Level Sensor, versions RE400-179-5 to RE400-189-5 (numbered by length of sensor); the Hydrostatic Sensor, version RE400-042-5; the Overfill Sensor, versions RE400-05 (8,9)-5 and RE400-14 (7,8)-5 (numbered by float logic and well cap size); the Sump Sensor, version RE400-111-5; and the Optical Liquid Discrimination Sensor, version RE400-203-5 were evaluated for use as liquid-phase product detectors in accordance with **ss. Comm 10.61 (5) to (8)**. These sensors were also evaluated for use in line leak detection in conjunction with the PPM 4000, RLM 9000, ST 1401L, ST 1801L, and ProLink Sensor Network Card.

DESCRIPTION AND USE

RLM 5000, RLM 5001, and RLM 9000 Tank Tightness Testing Systems

The Red Jacket RLM 5000, RLM 5001 and RLM 9000 may be used as volumetric tank tightness testing methods for tanks containing gasoline, diesel fuel, aviation fuel, fuel oil #4, solvents, waste oil, and ethanol and methanol and their alcohol-gasoline blends.

The RLM 5000, RLM 5001 and RLM 9000 are capable of detecting the presence of water in the bottom of the tank. Changes in water level are measured by the systems.

The probe is permanently installed and the maximum test time is 8 hours. Data is collected until statistically significant data is obtained.

Tank deformation changes and stabilization effects are minimized by waiting the specified time period before beginning the test.

Leak rates are calculated using viable data determined by statistical volumetric analysis. Test results are considered to be inconclusive if there is too much variability in the data. Tests should be conducted in accordance with the manufacturer's recommended procedures.

There are no acceptable deviations in standard testing protocol. Extension of the waiting period between filling the tank and conducting the test beyond the minimum may be determined by the testing personnel on site.

RLM 5000, RLM 5001, and RLM 9000 Automatic Tank Gauging Systems

The Red Jacket RLM 5000, RLM 5001 and RLM 9000 may be used as automatic tank gauges for tanks containing gasoline, diesel fuel, aviation fuel, fuel oil #4, solvents and waste oil, and ethanol and methanol and their alcohol-gasoline blends.

The ATG systems detect the presence of water in the bottom of the tank and measure the inflow of water as well as the loss of product.

Leak rates are calculated using the data determined to be valid through statistical volumetric analysis. Test results are considered to be inconclusive if there is too much variability in the data. Tests should be conducted in accordance with the manufacturer's recommended procedures.

There are no acceptable deviations in the standard test protocol.

ST 1400, ST 1401, ST 1401L, ST 1800, ST 1801, ST 1801L and Prolink Ultrasonic Tank Testing and Gauging Systems

The ST series provides continuous tank testing for leaks, in addition to running standard tightness testing and monthly monitoring tests.

The Red Jacket ST 1400, ST 1800 and Prolink Ultrasonic systems may be used on tanks containing gasoline, diesel fuel, aviation fuel, solvents, fuel oil #4 and #6, ethanol, ethanol-gasoline mixtures and other liquids compatible with the probe and characterized for ultrasonics. The equipment is capable of detecting the presence of water in the bottom of the tank. Changes in water level are measured by a water sensor that must be attached to the probe.

Tank deformation changes and stabilization effects are minimized by waiting the specified 7- to 12-hour time period before beginning the test.

There are no acceptable deviations in standard testing protocol. Extension of the waiting period between filling the tank and conducting the test beyond the minimum may be determined by the testing personnel on site.

Prolink Tank Testing and Gauging System

The Prolink system consists of a variable number of discrete network cards linked together over a common network interface. Each discrete network card performs its own tasks and processes its own information, and “publishes” this information onto the network for use by other network card or network management tools. One such network card is a magnetostrictive sensor card, which interfaces to a magnetostrictive sensor, processes the data, performs leak detection and issues the test results onto the network, where they may be retrieved by another network card or a network management tool such as a personal computer. Another network card is the Prolink Ultrasonic Network Card that performs the same testing and gauging functions as the ST series systems.

This system may be used on tanks containing gasoline, diesel fuel, aviation fuel, solvents, fuel oil #4 and #6, waste oil, and other liquids with temperature characteristics that can be determined and which are compatible with the probe. The equipment is capable of detecting the presence of water in the bottom of the tank. Changes in water level are measured by a water sensor that must be attached to the probe. Changes in product level are measured with a magnetostrictive float in the case of the magnetostrictive network card or with sound waves when the ultrasonic card is used.

Tank deformation changes and stabilization effects are minimized by waiting the specified time period of more than 12 hours before beginning the test.

There are no acceptable deviations in the standard testing protocol.

PPM 4000, RLM 9000, ST 1401L, ST 1801L, CPT and Prolink Line Leak Detection Systems

These systems may be used on lines containing gasoline, diesel, aviation fuel, alcohol and their blends with gasoline and some solvents. The ST 1401L, ST 1801L, CPT and Prolink systems may also be used on lines containing fuel oil #4. The control units are microprocessor controlled, automatic line leak detectors that differentiate between the types of signals produced by thermal contraction, line leaks and trapped air. The system monitors the product line between the tank and dispenser, including pump manifold and discharge line.

Tests are initiated after each operation of the submersible pump and may be conducted on demand. Annual line tightness testing may be manually initiated.

Time and pressure are both monitored by the console with the results displayed continuously on a liquid crystal display. The microprocessor stores information, determines if a leak exists and shuts down the system if a leak is detected. The control unit may be programmed to transmit leak alarm conditions or daily status reports to a remote location through a modem.

Three levels of tests are conducted automatically in the following sequence:

1. A Catastrophic Level Test is automatically conducted each time the pump is turned on. Large leaks of the order of 10 gallons per hour are detected in approximately eight seconds.
2. If the system passes the catastrophic level test, a Standard Level Test and a Precision Level Test are conducted sequentially after the pump is shut off. These tests will detect leaks small enough to meet the monthly monitoring and annual tightness test requirements specified in the EPA test protocol.
3. A Precision Level Test that will detect leaks as small as 0.1 gallons per hour in 35 minutes is conducted if the system passes the standard level test and the pump remains off for the required time period.

All models under this section rely on a precision functional element or "pressurestat" to hold the line pressure at 11 to 22 psi after the pump is shut off. The adjustable precision functional element is normally installed directly in the submersible pump for lines up to 4 inches in diameter. For systems that do not have adjustable functional elements in the pump, a remote functional element may be installed in the line itself. The purpose of the ELD is identical to that of the precision functional element, which is to hold the line pressure at 11 to 22 psi when the pump is shut off. The location of the functional element is of no consequence to the test time since its only function is to reduce the line pressure to within a set range. The ST 1401L, ST 1801L, CPT and ProLink systems include a high pressure algorithm.

Liquid-Phase Product Detectors

The Red Jacket Liquid-Phase Product Detectors, used with an approved monitor, provide continuous sampling frequency and a qualitative output.

Sensors must be placed so that they will be able to detect a leak in any portion of the primary containment which routinely contains product. The geometry of the containment area in which the sensor is placed must be such that the system will be able to detect a 0.2 gph or 150-gallon release within 30 days.

TESTS AND RESULTS

The performance of the RLM 5000, RLM 5001 and RLM 9000 leak detection systems was evaluated in accordance with the EPA protocol for volumetric tank testing methods. The systems were found to be capable of detecting a leak of 0.1 gallon per hour with a P_{FA} of 1 percent and a P_D of 99 percent when using a threshold of 0.05 gph.

The performance of the RLM 5000, RLM 5001 and RLM 9000 was also evaluated using the EPA protocol for automatic tank gauging methods. The systems were found to be capable of detecting a

leak of 0.2 gallon per hour with a P_{FA} of less than 0.5 percent and a P_D of 99.9 percent when using a threshold of 0.058 gph.

The performance of the ST 1400, ST 1800 and Prolink Ultrasonic leak detection systems were evaluated in accordance with the EPA protocol for volumetric tank tightness testing methods, by ADA Technologies, Inc. The systems were found capable of detecting a leak of 0.1 gallon per hour with a P_D of 99.4 percent and a P_{FA} of 2.01 percent when using a threshold of 0.05 gph.

The performance of the ST 1400, ST 1800 and Prolink Ultrasonic were also evaluated using the EPA protocol for automatic tank gauging methods, by ADA Technologies. The systems were found capable of detecting a 0.2 gph leak with a P_D of 99.9 percent and a P_{FA} of 2.98 percent when using a threshold of 0.09 gph.

The performance of the Prolink magnetostrictive leak detection system was evaluated in accordance with the EPA protocol for volumetric tank tightness testing methods, by ADA Technologies, Inc. The system was found capable of detecting a leak of 0.1 gallon per hour with a P_D of greater than 95 percent and a P_{FA} of less than 5 percent when using a threshold of 0.035 gph.

The performance of the Prolink magnetostrictive system was also evaluated using the EPA protocol for automatic tank gauging methods, by ADA Technologies. The system was found capable of detecting a 0.2 gph leak with a P_D of greater than 99.95 percent and a P_{FA} of less than 0.005 percent when using a threshold of 0.1 gph. The system was also found to meet the federal performance standard of measuring water in the bottom of the tank to the nearest 1/8 inch.

The performance of the Red Jacket PPM 4000, RLM 9000, ST 1401L, ST 1801L, CPT and Prolink pipeline monitoring systems was determined using the EPA protocol for evaluation of pipeline leak detection systems. When used as an hourly line leak detector, these systems are capable of detecting a 3 gallon per hour leak at 10 psi with a probability of false alarm (P_{FA}) of 0 percent and probability of detection (P_D) of 100 percent. When used for monthly monitoring, these systems are capable of detecting a 0.2 gallon per hour leak at 20 psi with a P_{FA} of 0 percent and a P_D of 100 percent. When used as a line tightness test, the systems are capable of detecting a 0.1 gallon per hour leak at 45 psi with a P_{FA} of 0 percent and a P_D of 100 percent.

LIMITATIONS OF APPROVAL

Procedures specified by the Marley Pump Company shall be used for the installation and maintenance of equipment and to conduct all tests.

Records of sampling, testing or monitoring shall be maintained in accord with **s. Comm 10.625 (2)**.

RLM 5000, RLM 5001 and RLM 9000 Tank Testing and Gauging Systems

The RLM 5000, RLM 5001 and RLM 9000 tank test systems are approved for use on tank sizes no larger than 15,000 gallons.

When used as a tank tightness test, the difference between the temperature of added product and in-tank product shall be no greater than + or - 8.0°F, and the tank shall be filled to at least 95 percent capacity during the test.

When used as an automatic tank gauge, the difference between the temperature of added product and in-tank product shall be no greater than + or - 8.0°F, and the tank shall be filled to at least 50 percent capacity during the test.

The waiting time between adding a substantial amount of product to the tank and the start of data collection shall be at least 6 hours.

ST 1400, ST 1401, ST 1401L, ST 1800, ST 1801, ST 1801L and Prolink Ultrasonic Tank Testing and Gauging Systems

The ST 1400 and ST 1800 tank test systems are approved for use on tanks up to 73,500 gallons.

When used as a tank tightness test, the difference between the temperature of added product and in-tank product shall be no greater than + or - 6.0°F, and the tank shall be filled to at least 95 percent capacity during the test.

When used as an automatic tank gauge, the difference between the temperature of added product and in-tank product shall be no greater than + or - 8.0°F, and the tank shall be filled to a height of at least 15 inches of product during the test. The waiting time between adding a substantial amount of product to the tank and the start of data collection shall be at least 12 hours for the tank tightness test and at least 10 hours for operation as an automatic tank gauge.

Prolink Magnetostrictive Tank Testing and Gauging System

The Prolink magnetostrictive tank test system is approved for use on tanks up to 18,000 gallons.

The difference between the temperature of added product and in-tank product shall be no greater than + or - 8.9°F, and the tank shall be filled to at least 50 percent capacity during the test.

The waiting time between adding a substantial amount of product to the tank and the start of data collection shall be approximately 12 hours to allow for temperature stabilization.

PPM 4000, RLM 9000, ST 1401L, ST 1801L, CPT and Prolink Line Leak Detection Systems

The PPM 4000 and RLM 9000 models may be used on rigid lines no larger than 55 gallons in capacity.

The PPM 4000 and the RLM 9000 may also be used on flexible lines. The line capacity may not exceed 300 feet of 2-inch pipe.

The ST 1401L, ST 1801L, CPT and Prolink systems may be used for hourly testing on rigid or flexible lines up to 172 gallons capacity, or 400 feet in length by 3 1/4 inches in diameter. These systems can be used for monthly or annual testing on rigid or flexible lines up to 163 gallons capacity, or 350 feet in length by 3 3/8 inches in diameter.

There is no required waiting time between dispensing or product delivery and beginning the tests.

The system installation shall follow the manufacturer's recommendations for each model.

Liquid-Phase Product Detectors

Approval of the placement of the sensors shall be obtained in accordance with **s. Comm 10.10**. Sensors shall be placed so they will detect a leak in any portion of the primary containment that routinely contains product. The configuration of the containment area in which the sensor is placed must be such that the system will be able to detect a 0.2-gph or 150-gallon release within 30 days.

USE OF APPROVAL

This approval will be valid through December 31, 2004, unless manufacturing modifications are made to the product or a re-examination is deemed necessary by the Department. The Wisconsin Material Approval Number must be provided when plans that include this product are submitted for review.

DISCLAIMER

The Department is in no way endorsing or advertising these products. This approval addresses only the specified applications for the products and does not waive any code requirement unless specified herein.

Reviewed by: _____

Approval Date: _____ By: _____

Duane Hubeler, P.E.
Code Consultant
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